



6712-01

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 15 and 95

[ET Docket No. 16-56, ET Docket No. 14-165, GN Docket No. 12-268, RM-11745, FCC 19-24]

Unlicensed White Space Devices

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: In the Report and Order, the Federal Communications Commission (Commission) takes steps to improve the accuracy and reliability of fixed white space device data recorded in the white space databases and assure that the potential for these devices to cause interference to protected services is minimized. In the Order on Reconsideration, the Commission modifies the white space device antenna height rules to allow improved broadband coverage in rural areas, and resolves certain outstanding white space reconsideration issues. White space devices are used to provide a variety of wireless services, including broadband data.

DATES: Effective **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, except for § 95.2309, which is delayed. We will publish a document in the Federal Register announcing the effective date.

ADDRESSES: Federal Communications Commission, 445 12th Street, SW, Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Mr. Hugh L. Van Tuyl at (202) 418-7506, or Hugh.VanTuyl@fcc.gov.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's *Report and Order and Order on Reconsideration*, ET Docket No. 16-56, ET Docket No. 14-165, and RM-11745, FCC 19-24, adopted March 19, 2019 and released March 20, 2019. The full text of this document is available for public inspection and copying during normal business hours in the FCC

Reference Center (Room CY-A257), 445 12th Street, SW, Washington, DC 20554, or by downloading the text from the Commission's web site at <https://www.fcc.gov/document/amendment-part-15-rules-unlicensed-white-spaces-devices>. Alternative formats are available for people with disabilities (Braille, large print, electronic files, audio format) by sending an email to fcc504@fcc.gov or calling the Commission's Consumer and Governmental Affairs Bureau at (202) 418–0530 (voice), (202) 418–0432 (TTY).

Synopsis

REPORT AND ORDER

1. In this Report and Order, the Commission adopts certain changes to the rules for fixed white space devices. Specifically, it requires all fixed white space devices to incorporate a geo-location capability such as GPS and eliminates the option that permitted the geographic coordinates of a fixed device to be determined by a professional installer. The Commission also will allow the use of external geo-location sources by a fixed white space device when the device is used at a location where its internal geo-location capability does not function, such as deep inside a building. In addition, the Commission will require fixed white space devices to periodically re-check their geographic coordinates at least once a day and report the coordinates to the white space database.

2. *Fixed device location data* – The Commission will require all fixed white space devices to include an internal geo-location capability to determine their geographic coordinates and require that fixed white space devices automatically provide their coordinates to the database when the device is registered. These actions will help ensure the accuracy of information provided to the white space database, thus reducing the likelihood of imprecise registered coordinates for fixed white space devices. These actions will also enable simpler “do-it-yourself” installations of certain fixed devices, such as those where a professional installer is not needed to mount an antenna on a tall structure. Additionally, these actions will provide a means for a fixed

white space device to automatically re-establish its coordinates if they are lost or altered due to a power outage or equipment reboot. The Commission does not believe that these requirements are overly burdensome because manufacturers can incorporate a variety of location technologies into their devices. Many of these, such as GPS and Wi-Fi, are widely available at low cost.

3. *External geo-location capability* – The Commission will allow fixed white space devices to obtain their geographic coordinates through an external geo-location source when they are used at locations where their internal geo-location capability does not function, such as deep inside a building. It will allow an external geo-location source to be connected to a fixed device through either a wired or a wireless connection and allow a single geo-location source to provide location information to multiple fixed devices. The Commission will require that an external geo-location source be connected to a fixed device using a secure connection that ensures only an external geo-location source that has been approved with a particular fixed device can provide geographic coordinates to that device. Additionally, the Commission will allow the use of extender cables to connect a remote receive antenna to a geo-location receiver within a fixed device. For any of these scenarios, the Commission requires the applicant for equipment certification to demonstrate the location uncertainty with a confidence level of 95%, and that the device reports the location uncertainty correctly to the database. These changes will increase the flexibility that manufacturers have to develop fixed white space devices that can be used in a wide variety of locations while ensuring devices accurately determine their location and report it to the white space database to prevent harmful interference to protected services.

4. *Geo-location accuracy requirement* – The Commission does not make any changes to the location accuracy rules in the Report and Order. It affirms the location accuracy rules adopted in the *TV White Spaces Order*, 80 FR 73044, in the Order on Reconsideration.

5. *Daily database contact to report geographic coordinates* – The Commission requires that a fixed white space device verify its coordinates at least once per day, except when not in operation, and report its geographic location to the database when it makes a request for a

list of available channels. This action serves to improve the accuracy of the coordinates that fixed white space devices report to the database by providing multiple observations that could be used to reduce the uncertainty of the device's location. It will also provide a safeguard that allows the coordinates to be re-established if they are inadvertently or deliberately altered. Because the daily re-check of coordinates and transmission of them to the white space database will be automatic, this change will not be burdensome on the users of fixed white space devices.

6. *Re-registration of devices when moved or coordinates altered* – The Commission requires that a fixed white space device's coordinates and antenna height above ground be re-established and the device registered with the database when it is moved or when its coordinates are altered by more than ± 50 meters from the last registered location. By limiting this requirement to location changes greater than 50 meters, the Commission ensures that fixed devices will not have to re-register with the database repeatedly for small changes in coordinates that have no effect on channel availability. When a fixed device is moved, or its coordinates are changed by more than 50 meters, the database will have accurate information necessary to determine the channels available for use by the device.

7. *Determining antenna height above ground* – The Commission will not require that fixed white space devices automatically determine their antenna height above ground. Instead, the Commission will allow the installer or operator of the device to manually enter the height but will also provide the option for devices to determine their antenna height automatically. The accuracy of height measurements determined by GPS is lower than the accuracy of geographic coordinates determined by GPS, and a GPS receiver in a fixed white space device may be at a lower elevation than the transmit antenna, introducing sources of uncertainty into height determination. Given the current state of technology, the Commission finds it inappropriate to require white space devices and databases to use automatically determined antenna height information that may be in error at a particular location. Erroneous

height data could preclude operation of a fixed device if the antenna height above ground reported to the database is outside of the allowable range. The Commission recognizes that improvements in technology in the future could enable white space devices to more accurately determine their antenna height above ground, so it provides the option for fixed white space devices to automatically determine their antenna height above ground.

8. The Commission finds NAB's suggestion to allow the database to assume a 10-meter default antenna height when an automatically determined antenna height is out of range to be an inadequate method of compensating for errors. Thus, the Commission concludes that it should continue to permit the installer of a device to manually enter the antenna height above ground. While the Commission recognizes NAB's concern about potential errors in antenna heights entered by a professional installer, it believes that installers will generally be able to accurately determine the antenna height above ground. Further, minor errors in the reported antenna height above ground of a fixed white space device will in many cases have no impact on the protection of television services since the protection distances that a fixed device must meet are the same across ranges of antenna heights.

9. *Transition provisions* – The Commission requires that fixed white space devices that are approved by Telecommunication Certification Bodies (TCBs) beginning six months after the effective date of the rules adopted in this proceeding to comply with the new rules. The Commission also permits the continued marketing of previously approved devices that do not comply with the new rules until 18 months after the effective date of the rules. These deadlines provide sufficient time to develop compliant products and provide the industry with flexibility to tailor manufacturing and importation cutoff dates to suit the relevant circumstances. The 18-month marketing cutoff date also applies to parties other than the manufacturer, so owners of white space devices that do not comply with the new rules will not be permitted to re-sell the non-compliant devices after this date. The Commission does not establish any operational cutoff for

users of previously approved fixed white space devices that do not comply with the new rules because the number of those devices is relatively small, as is the likelihood that they would cause interference.

10. *Fixed device registration* – The Commission requires that the operator of a fixed white space device be responsible for the accuracy of the registration information, because that is the party capable of shutting down the device as required by the part 15 rules in the event the device causes harmful interference. The operator could be the owner of the device or another party that has the capability to control and deactivate the device. The fixed device registration must therefore provide the contact information for the operator of the fixed device. The Commission permits a party such as a professional installer to submit the registration information on behalf of the owner or operator, but the operator of the device will ultimately be responsible for ensuring its accuracy.

11. *Verification of registration information* – The Commission declines to adopt its proposal to require database administrators to verify e-mail addresses or phone numbers for fixed device registrations (81 FR 15210). The Commission believes this requirement is unnecessary and would be unduly burdensome for database operators because of the time and expense that would be required to redesign their systems to enable verification of contact information and to actually verify the information for each fixed device registration. The database administrators have already taken steps to ensure that operators of fixed white space devices supply all necessary information for a device registration and to reject information that is clearly erroneous. Additionally, requiring database administrators to hold new or modified registrations inactive until they verify the registrant's contact information could delay service to fixed white space device users.

ORDER ON RECONSIDERATION

12. In this *Order on Reconsideration*, the Commission addresses several petitions for reconsideration of the actions it took in the *TV White Spaces Order*. The Commission affirms

most of the its decisions, with the exception of increasing the maximum permissible fixed white space device antenna height above ground level in less congested areas. The Commission will address at a later time those petitions concerning push notifications and white space device operation on Channel 37. The Commission previously addressed petitions related to wireless microphones.

Low Power fixed devices

13. *Operation within adjacent channel television contours* - The Commission denies NAB's request to reconsider the decision to permit fixed white space devices to operate with 40 milliwatts EIRP within the contour of adjacent channel television stations with an antenna height that does not exceed 10 meters above ground level. The Commission is not persuaded that permitting such operation poses a significant threat of harmful interference to adjacent channel television reception. Interference to television reception from an adjacent channel transmitter occurs when the signal from that transmitter is substantially greater than the received television signal level and is most likely to occur where the television signal is weak, such as at the edge of a station's coverage area where an outdoor directional rooftop television antenna would be needed to obtain good reception. The highest likelihood of harmful interference occurring would be when the main beams of both antennas are pointed towards each other when the devices are in close proximity. Because fixed white space devices must use directional antennas with a gain of at least 6 dBi to reach the 40-milliwatt EIRP level allowed by the rules, the Commission expects this to be a low probability event. Moreover, even if all factors were to align and create a worst-case situation, the Commission disagrees with NAB's claim that 160-meter separation would be required to protect television reception from a 40-milliwatt white space device. Using the -84 dBm threshold for a UHF-television signal and applying the -33 dB D/U ratio for adjacent channel interference and assuming worst-case free space loss, a 40-milliwatt white space device need only be separated from a television antenna by 88 meters; significantly less than the distance claimed by NAB. While the Commission recognizes that this distance is not *de minimis*, it notes

that it is based on the low probability event of several worst-case conditions occurring simultaneously. The majority of over-the-air television reception occurs at higher signal levels than assumed here, and white space device signals are likely to attenuate faster than assumptions of free space propagation would indicate. Other factors are also likely to decrease the distance at which interference could occur, including the mismatch between the directivity of the white space transmit and the television receive antennas, and any intervening obstacles between the antennas. The Commission does not believe that the low probability case where all worst-case conditions occur simultaneously should lead it to adopt overly restrictive requirements, and points out that if a white space device causes harmful interference to television reception, it must remedy such interference up to and including ceasing operation.

14. *Power limits* - The Commission denies Microsoft's request to change the rule that requires fixed devices to use a directional antenna with at least 6 dBi gain in order to transmit at the 40-milliwatt limit. While in many situations an indoor 40-milliwatt fixed device with an omnidirectional antenna would pose no more risk of interference than a personal/portable device operating at 40 milliwatts with an omnidirectional antenna, the Commission notes that in modifying the rules to allow low power fixed devices to operate inside the contour of an adjacent television channel, it relied on the directional antenna requirement to ensure a low probability for causing interference. The Commission further notes that devices do not specify to the database whether operation is indoors or outdoors, so there is no way to distinguish such operations and permit omnidirectional antennas indoors and require directional antennas outdoors. Because the Commission requires all fixed devices to incorporate a geo-location capability and comply with minimum separation distances from registered licensed wireless microphones, it disagrees with Shure's contention that a fixed white space device that operates indoors would have any greater potential for causing interference to wireless microphones than fixed devices used outdoors.

15. The Commission concludes that it is unnecessary to address whether in-home wireless routers are fixed devices and consequently whether moving a router from one area of a

house to another would be a *de minimis* change in location that would require professional re-installation.

16. *Operation on contiguous channels* - The Commission denies Carlson/Cal.net's request to increase the maximum allowable power above 100 milliwatts EIRP for fixed white space devices that operate on two or more contiguous vacant channels with a three-megahertz frequency separation from occupied adjacent television channels. Carlson/Cal.net does not explain what it believes to be the correct interference analysis assumptions, and does not justify its assertion that orthogonal polarization between a white space device transmit antenna and a television receive antenna will result in 12-15 dB of signal attenuation. Carlson/Cal.net indicates that it has not performed testing to demonstrate whether fixed white space devices could operate at four watts EIRP without causing interference to television reception when operating with only three-megahertz frequency separation from an occupied adjacent television channel, and no other party has provided relevant test results. For those reasons, the Commission upholds its decision to limit fixed white space devices that operate on contiguous vacant channels to 100 milliwatts EIRP, or to 50 milliwatts EIRP on a channel with a three-megahertz frequency separation from an occupied adjacent television channel.

17. *Variable power levels* – The Commission denies NAB's request to make certain modifications to the rules intended to ensure that white space devices operate only on authorized channels and at authorized power levels. It declines to require white space devices to report their operating channels and power levels to the database, noting that it previously considered and rejected a similar request and stating that NAB has not provided any information that would persuade the Commission to change its previous decision. The Commission disagrees with NAB that the rules provide no guidance or mechanisms to ensure that white space devices will operate as required. It notes that both fixed and Mode II personal/portable devices are subject to requirements that operation is permitted only on channels and at power levels that are indicated in the database as being available for the device, and that operation on a channel must cease

immediately or power must be reduced to a permissible level if the database indicates that the channel is no longer available at the current operating level. The Commission also notes that white space devices may not contain an interface that allows users to select higher power levels than the database indicates are available for a channel at a given location, and that a manufacturer must demonstrate that a white space device will comply with these requirements in order to obtain certification for the device. Thus, the Commission concludes that it does not need to impose additional requirements on white space devices to implement the rules that allow operation at a variety of power levels.

Fixed white space device antennas

18. *Antenna height above ground level and average terrain* – The Commission grants WISPA’s request to increase the maximum allowable antenna height above ground for fixed white space devices, but denies its request to increase the maximum antenna height above average terrain. The increase in allowable fixed white space device antenna height above ground level from 30 meters to 100 meters in less congested areas will allow for improved wireless broadband service to persons in rural and other underserved areas. A 100-meter height above ground level limit will permit antennas to be mounted on towers or other structures at heights sufficient to clear intervening obstacles such as trees and hills that would attenuate the transmitted signal, thereby increasing the range at which the signal can be received. Less congested areas will have many vacant channels and therefore a low likelihood that increased antenna height above ground level would affect other operations in the television bands. The Commission may consider increasing the antenna height above average terrain limit in the future if it has a more complete record addressing this issue.

19. *Antenna Directivity* - The Commission denies WISPA’s request for reconsideration of its decision to prohibit television white space databases from considering fixed device antenna directivity in determining channel availability. The Commission lacks sufficient information to develop rules that would ensure that television and other services are protected

from harmful interference. Allowing consideration of directional antenna patterns would add additional complexity to the operation of fixed devices and the white space databases, since there are many factors that would have to be addressed. The database would have to contain information describing fixed white space device antenna patterns, and the Commission may need to specify additional requirements such the size of the arc over which white space devices must limit their power or minimum separation distances at additional power levels. Additionally, the Commission would need to address how to ensure that the orientation of a directional antenna is accurately reported to the white space database. The Commission could consider this issue again in the future.

20. *Geo-location accuracy requirement* – The Commission denies NAB’s request to modify the location uncertainty rules. It finds that NAB’s request to limit the maximum geo-location uncertainty to ± 100 meters is overly restrictive and would eliminate most of the flexibility that the Commission provided in adopting this rule since it would allow only an additional 50 meters of uncertainty for less precise location technologies. The Commission disagrees with NAB that it is necessary to specify an upper limit on location uncertainty. Because a higher location uncertainty requires an increase in separation distances from protected services, manufacturers will have an incentive to determine a device’s location as precisely as possible to maximize the number of channels that a device can use.

21. The Commission does not believe it is necessary to modify the rules to require the use of the ETSI EN 301 598 standard for determining a device’s location accuracy. It expects that many manufacturers may wish to use this standard because it addresses measurements they need to make, but does not want to preclude the use of other standards or measurement methods that may be developed in the future.

PROCEDURAL MATTERS

22. *Final Regulatory Flexibility Analysis.* —The Final Regulatory Flexibility Analysis, required by the Regulatory Flexibility Act, *see* 5 U.S.C. 604, is contained in Appendix D of the Report and Order and Order of Reconsideration.

23. *Paperwork Reduction Act.* —This document contains modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Pub. Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new or modified information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Pub. Law 107-198, *see* 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

24. The Commission has assessed the effects of the policies adopted in this Report and Order and Order on Reconsideration with regard to information collection burdens on small business concerns, and find that these policies will benefit many companies with fewer than 25 employees by providing unlicensed white space devices and unlicensed wireless microphones with access to spectrum in the television broadcasting band and the 600 MHz band, while at the same time protecting licensed users from harmful interference. In addition, we have described impacts that might affect small businesses, which includes most businesses with fewer than 25 employees, in the Final Regulatory Flexibility Analysis in Appendix D of the Report and Order and Order of Reconsideration.

25. *Congressional Review Act.* — The Commission will send a copy of this Report and Order and Order on Reconsideration to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

Ordering Clauses

26. IT IS ORDERED that, pursuant to the authority contained in sections 4(i), 302, 303(b), (c), (e), (f), (r), and 307 of the Communications Act of 1934, as amended, and sections 6403 and 6407 of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156, 47 U.S.C. 154(i), 302, 303(b), (c), (e), (f), (r), 307, 1452, 1454, this Report and Order and Order on Reconsideration IS HEREBY ADOPTED.

27. IT IS FURTHER ORDERED that part 15 of the Commission's rules IS AMENDED as specified below, and such rule amendments WILL BECOME EFFECTIVE 30 days after the date of publication in the *Federal Register*.

28. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the Report and Order and Order on Reconsideration, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the U.S. Small Business Administration.

29. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of the Report and Order and Order on Reconsideration in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. section 801(a)(1)(A).

List of Subjects

47 CFR Part 15

Communications equipment, Radio, Reporting and recordkeeping requirements.

47 CFR Part 95

Communications equipment, Radio.

FEDERAL COMMUNICATIONS COMMISSION

Marlene Dortch,
Secretary.

Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR parts 15 and 95 as follows:

PART 15—RADIO FREQUENCY DEVICES

1. The authority citation for part 15 continues to read as follows:

Authority: 47 U.S.C. 154, 302a, 303, 304, 307, 336, 544a, and 549.

2. Section 15.37 is amended by revising the section heading and adding paragraph (q) to read as follows:

§ 15.37 Transition provisions for compliance with this part.

* * * * *

(q) All fixed white space devices which are approved by Telecommunication Certification Bodies on or after [February 19, 2020](#) or that are marketed on or after [February 19, 2021](#) shall comply with the requirements of §15.711(c). Fixed white space devices which are approved or marketed before the dates in the preceding sentence shall comply with either the requirements of §15.711(c) or the requirements of §15.711(c) as in effect prior to **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]** (see 47 CFR part 15 as revised October 1, 2018).

3. Section 15.703 is amended by revising paragraphs (a), (b), and (c), removing the note to paragraphs (a), (b), and (c), and revising paragraphs (o) and (r) to read as follows:

§ 15.703 Definitions.

(a) *600 MHz duplex gap*. An 11 megahertz guard band at 652-663 MHz that separates part 27 600 MHz service uplink and downlink frequencies.

(b) *600 MHz guard band.* Designated frequency band at 614-617 MHz that prevents interference between licensed services in the 600 MHz service band and channel 37.

(c) *600 MHz service band.* Frequencies in the 617-652 MHz and 663-698 MHz bands that are reallocated and reassigned for 600 MHz band services under part 27 of this chapter.

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(o) *Sensing only device.* A personal/portable white space device that uses spectrum sensing to determine a list of available channels. Sensing only devices may transmit on any available channels in the frequency bands 512-608 MHz (TV channels 21-36).

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(r) *Television bands.* The broadcast television frequency bands at 54-72 MHz (TV channels 2-4), 76-88 MHz (TV channels 5-6), 174-216 MHz (TV channels 7-13) and 470-608 MHz (channels 14-36).

* * * * *

4. Section 15.707 is amended by revising paragraph (a) to read as follows:

§ 15.707 Permissible channels of operation.

(a)(1) *470-698 MHz band.* All white space devices are permitted to operate on available channels in the frequency bands 470-698 MHz (TV channels 14-51), subject to the interference protection requirements in §§15.711 and 15.712.

(2) *600 MHz duplex gap.* White space devices may operate in the 657-663 MHz segment of the 600 MHz duplex gap.

(3) *600 MHz service band*. White space devices may operate on frequencies in the bands 617-652 MHz and 663-698 MHz in areas where 600 MHz band licensees have not commenced operations, as defined in §27.4 of this chapter.

(4) *Channel 37 guard band*. White space devices are not permitted to operate in the band 614-617 MHz.

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5. Section 15.709 is amended by revising paragraphs (a)(3), (b)(1) and (2), and (g)(1)(i) to read as follows:

§15.709 General technical requirements.

(a) * * *

(3) *608-614 MHz band (channel 37)*. Up to 40 mW (16 dBm) EIRP.

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(b) * * *

(1) *Fixed white space devices*. (i) Technical limits for fixed white space devices are shown in the table in paragraph (b)(1)(iii) of this section and subject to the requirements of this section.

(ii) For operation at EIRP levels of 36 dBm (4000 mW) or less, fixed white space devices may operate at EIRP levels between the values shown in the table in paragraph (b)(1)(iii) of this section provided that the conducted power and the conducted power spectral density (PSD) limits are linearly interpolated between the values shown and the adjacent channel emission limit of the higher value shown in the table is met. Operation at EIRP levels above 36 dBm (4000 mW) shall follow the requirements for 40 dBm (10,000 mW).

(iii) The conducted power spectral density from a fixed white space device shall not be greater than the values shown in the table in this paragraph (b)(1)(iii) when measured in any 100 kHz band during any time interval of continuous transmission.

Table 1 to Paragraph (b)(1)(iii)

EIRP (6 MHz)	Conducted power limit (6 MHz)	Conducted PSD limit (100 kHz)	Conducted adjacent channel emission limit (100 kHz)
16 dBm (40 mW)	10 dBm (10 mW)	-7.4 dBm	-62.8 dBm
20 dBm (100 mW)	14 dBm (25 mW)	-3.4 dBm	-58.8 dBm
24 dBm (250 mW)	18 dBm (63 mW)	0.6 dBm	-54.8 dBm
28 dBm (625 mW)	22 dBm (158 mW)	4.6 dBm	-50.8 dBm
32 dBm (1600 mW)	26 dBm (400 mW)	8.6 dBm	-46.8 dBm
36 dBm (4000 mW)	30 dBm (1000 mW)	12.6 dBm	-42.8 dBm
40 dBm (10000 mW)	30 dBm (1000 mW)	12.6 dBm	-42.8 dBm

(2) *Personal/portable white space devices.* (i) Technical limits for personal/portable white space devices are shown in the table in paragraph (b)(2)(ii) of this section and subject to the requirements of this section.

(ii) The radiated power spectral density from a personal/portable white space device shall not be greater than the values shown in the table in this paragraph (b)(2)(ii) when measured in any 100 kHz band during any time interval of continuous transmission.

Table 2 to Paragraph (b)(2)(ii)

EIRP (6 MHz)	Radiated PSD limit EIRP (100 kHz)	Radiated adjacent channel emission limit EIRP (100 kHz)
16 dBm (40 mW)	-1.4 dBm	-56.8 dBm

20 dBm (100 mW)	2.6 dBm	-52.8 dBm
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(g) *Antenna requirements-(1) Fixed white space devices-(i) Above ground level.* The transmit antenna height shall not exceed 100 meters above ground level in less congested areas or 30 meters above ground level in other areas, except that the antenna height may not exceed 10 meters above ground level in any area for fixed white space devices operating in the TV bands at 40 mW EIRP or less or operating across multiple contiguous TV channels at 100 mW EIRP or less.

* * * * *

6. Section 15.711 is amended by revising paragraphs (c)(1) introductory text and (c)(1)(i), adding paragraphs (c)(1)(iii) and (iv), and revising paragraph (c)(2)(iii) to read as follows:

§15.711 Interference avoidance methods.

* * * * *

(c) *Requirements for fixed white space devices.* (1) The geographic coordinates of a fixed white space device shall be determined at the time of installation and first activation from a power off condition by an incorporated geo-location capability. The antenna height above ground shall be determined by the installer or operator of the device, or by an automatic means. This information shall be stored internally in the white space device and transmitted automatically by the device to the white space database. The operator of a fixed white space device shall be responsible for assuring the accuracy of the information registered in the white space database. If a fixed white space device is moved

to another location or if its stored coordinates become altered, the operator shall reestablish the device's:

(i) Geographic location through the incorporated geo-location capability and the antenna height above ground level and store this information in the white space device; and

* * * * *

(iii) A fixed white space device may obtain its geographic coordinates through an external geo-location source when it is used at a location where its internal geo-location capability does not function. An external geo-location source may be connected to a fixed device through either a wired or a wireless connection, and a single geo-location source may provide location information to multiple fixed devices. An external geo-location source must be connected to a fixed device using a secure connection that ensures that only an external geo-location source that has been approved with a particular fixed device can provide geographic coordinates to that device. The geographic coordinates must be provided automatically by the external geo-location source to the fixed device; users may not manually enter them. Alternatively, an extender cable may be used to connect a remote receive antenna to a geo-location receiver within a fixed device.

(iv) The applicant for certification of a fixed device must demonstrate the accuracy of the geo-location method used and the location uncertainty as defined in paragraph (b) of this section. For fixed devices that are not using an internal geo-location capability, this uncertainty must account for the accuracy of the geo-location source and the separation distance between such source and the white space device.

(2)* * *

(iii) Each fixed white space device shall access the database at least once a day to verify that the operating channels continue to remain available. Each fixed white space device must adjust its use of channels in accordance with channel availability schedule information provided by its database for the 48-hour period beginning at the time the device last accessed the database for a list of available channels. The fixed device's registration information shall be updated if the geographic coordinates reported to the database differ by more than ± 50 meters from the previously registered coordinates.

* * * * *

7. Section 15.712 is amended by revising paragraph (j) to read as follows:

§15.712 Interference protection requirements.

* * * * *

(j) *Wireless Medical Telemetry Service.* (1) White space devices operating in the 608-614 MHz band (channel 37) are not permitted to operate within an area defined by the polygon described in § 15.713(j)(11) plus the distances specified in the tables in this paragraph (j)(1):

(i) Mode II personal/portable white space devices.

Table 23 to paragraph (j)(1)(i)

	Required co-channel separation distances in kilometers from edge of polygon
	16 dBm (40 mW)
Communicating with Mode II or Fixed device	0.38
Communicating with Mode I device	0.76

(ii) Fixed white space devices, except that when communicating with Mode I personal/portable white space devices, the required separation distances must be increased beyond the specified distances by 0.38 kilometers.

Table 24 to paragraph (j)(1)(ii)

Antenna height above average terrain of unlicensed devices (meters)	Required co-channel separation distances in kilometers from edge of polygon
	16 dBm (40 mW)
Less than 3	0.38
3 - 10	0.70
10 – 30	1.20
30 – 50	1.55
50 – 75	1.90
75 – 100	2.20
100 – 150	2.70
150 – 200	3.15
200-250	3.50

(2) White space devices operating in the 602-608 MHz band (channel 36) and 614-620 MHz band (channel 38) are not permitted to operate within an area defined by the polygon described in § 15.713(j)(11) plus the distances specified in the tables in this paragraph (j)(2):

(i) Mode II personal/portable white space devices.

Table 25 to paragraph (j)(2)(i)

	Required adjacent channel separation distances in meters from edge of polygon	
	16 dBm (40 mW)	20 dBm (100 mW)
Communicating with Mode II or Fixed device	8	13

Communicating with Mode I device	16	26
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(ii) Fixed white space devices, except that when communicating with Mode I personal/portable white space devices, the required separation distances must be increased beyond the specified distances by 8 meters if the Mode I device operates at power levels no more than 40 mW EIRP, or 13 meters if the Mode I device operates at power levels above 40 mW EIRP.

Table 26 to paragraph (j)(2)(ii)

Required adjacent channel separation distances in meters from edge of polygon					
16 dBm (40 mW)	20 dBm (100 mW)	24 dBm (250 mW)	28 dBm (625 mW)	32 dBm (1600 mW)	36 dBm (4 watts)
8	13	20	32	50	71

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8. Section 15.713 is amended by revising paragraph (a)(1) to read as follows:

§ 15.713 White space database.

(a) * * *

(1) To determine and provide to a white space device, upon request, the available channels at the white space device's location in the TV bands, the 600 MHz duplex gap, the 600 MHz service band, and 608-614 MHz (channel 37). Available channels are determined based on the interference protection requirements in §15.712. A database must provide fixed and Mode II personal portable white space devices with channel availability information that includes scheduled changes in channel availability over the course of the 48-hour period beginning at the time the white space devices make a

recheck contact. In making lists of available channels available to a white space device, the white space database shall ensure that all communications and interactions between the white space database and the white space device include adequate security measures such that unauthorized parties cannot access or alter the white space database or the list of available channels sent to white space devices or otherwise affect the database system or white space devices in performing their intended functions or in providing adequate interference protections to authorized services operating in the TV bands, the 600 MHz duplex gap, the 600 MHz service band, and 608-614 MHz (channel 37). In addition, a white space database must also verify that the FCC identifier (FCC ID) of a device seeking access to its services is valid; under the requirement in this paragraph (a)(1) the white space database must also verify that the FCC ID of a Mode I device provided by a fixed or Mode II device is valid. A list of devices with valid FCC IDs and the FCC IDs of those devices is to be obtained from the Commission's Equipment Authorization System.

* * * * *

9. Section 15.714 is amended by revising paragraph (a) to read as follows:

§ 15.714 White space database administration fees.

(a) A white space database administrator may charge a fee for provision of lists of available channels to fixed and personal/portable devices and for registering fixed devices. This paragraph (a) applies to devices that operate in the TV bands, the 600 MHz service band, the 600 MHz duplex gap, and 608-614 MHz (channel 37).

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PART 95—PERSONAL RADIO SERVICES

10. The authority citation for part 95 continues to read as follows:

Authority: 47 U.S.C. 154, 303, 307.

11. Section 95.2309 is amended by adding paragraph (h) to read as follows:

§ 95.2309 WMTS frequency coordination.

* * * * *

(h) *Obtaining interference protection.* To receive interference protection, parties operating WMTS networks in the 608-614 MHz frequency band shall notify one of the white space database administrators of their operating location pursuant to §§ 15.713(j)(11) and 15.715(p) of this chapter.

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